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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/828,862	04/10/2001	Kiyotaka Imai	99600-1 DIV	7814

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EXAMINER
VU, QUANG D

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/828,862	IMAI, KIYOTAKA	
	Examiner	Art Unit	
	Quang D Vu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *amendment filed on 02/21/03* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 14 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification discloses a p-n junction formed by an As-doped region (the As-doped region formed at an acceleration energy of 50 KeV) and the p-type monocrystalline silicon region having a smaller leakage current than a p-n junction formed by an As-doped region (the As-doped region formed at an acceleration energy of 10 KeV) and the p-type monocrystalline silicon region (fig. 5, p,9, line 20 to p,10, line 18). The specification never discloses the first acceleration energy is reduced without increasing a p-n junction leakage current as claimed in claim 14.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in

> section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

4. Claims 8-10 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent No. 5,880,500 to Iwata et al.

Regarding claim 8, Iwata et al. (figure 1) teach a method for manufacturing a semiconductor device comprising:

implanting arsenic ions in a semiconductor substrate (100) at a first acceleration energy level to form an arsenic ion implanted region (108) (column 11, lines 8-15);

implanting phosphorous ions in the arsenic ion implanted region (impurity diffusion region [108]) at a second acceleration energy level (column 10, line 66 – column 11, line 3) lower than the first acceleration energy level; and

heat treating the ion implanted regions to activate the arsenic ions and phosphorous ions to form an n-type source/drain main region (108) comprising arsenic and phosphorous ions (column 11, line 59 – column 12, line 45), and an n-type source/drain buffer region (105) comprising phosphorous ions, the n-type source/drain buffer region (105) extending beyond the n-type source/drain main region (108).

Regarding claim 9, Iwata et al. teach the device comprises an n-type metal oxide semiconductor field effect transistor (NMOSFET).

Regarding claim 10, Iwata et al. teach the NMOSFET comprises a gate electrode (102) formed over a channel region (106), and wherein the n-type source/drain buffer region (105) separates the n-type source/drain main region (108) from the channel region (106).

Regarding claim 16, Iwata et al. teach the heat-treating step comprises heat-treating at about 1000^0 C for about 10 seconds (column 12, line 41).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 3-5, 6-7, 11-13, 15 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,880,500 to Iwata et al.

Regarding claim 3, Iwata et al. (figure 1) teach a method for manufacturing a semiconductor device. It comprises the steps of:

implanting arsenic ions in a semiconductor substrate (100) at a first acceleration energy level (column 11, lines 8-15);

implanting phosphorous ions at a second acceleration energy level (column 10, line 66 – column 11, line 3) lower than the first acceleration energy level, a phosphorous ion implanted region (105) extending beyond the arsenic ion implanted region (108); and

heat-treating the ion-implanted regions for activation of the arsenic ions and the phosphorous ions to form source/drain regions (column 11, line 59 – column 12, line 45).

It is inherent that the arsenic ion implanted regions suppress a reverse channel effect in the NMOSFET.

Since first acceleration energy level (50 keV) of the arsenic ions is greater than the second acceleration energy level (30keV) of the phosphorous ions, the concentration peak of the phosphorous ions would locate in the arsenic ion implanted regions.

Iwata et al. differ from the claimed invention by not showing implanting phosphorous ions in the arsenic ion implanted regions, following the arsenic ion implanting. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the order of forming. See Ex parte Rubin , 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter impregnated with a thermosetting material was held to render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.).

Regarding claim 4, Iwata et al. teach n-type impurities are implanted in the substrate to form an n-type extension region (impurity diffusion region [107]) before the arsenic and phosphorous implanting (column 10, lines 53 – 65).

Regarding claim 5, Iwata et al. teach an acceleration energy and a dosage of the phosphorous ion are determined such that an ion-implanted region (105) of the phosphorous ion extends beyond a bottom surface of an ion-implanted region (108) of the arsenic ion. It is inherent that a dosage of the arsenic ion is determined to obtain desired electrical characteristics for the semiconductor device.

Regarding claim 6, Iwata et al. differ from the claimed invention by not showing the acceleration energy of the arsenic ion is not higher than 15 keV, and the acceleration energy of the phosphorous ion is not higher than 10 keV and is lower than that of the arsenic ion. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the acceleration energy of the arsenic ion is not higher than 15 keV, and the acceleration energy of the phosphorous ion is not higher than 10 keV and is lower than that of the arsenic ion, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involve only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 7, Iwata et al. differ from the claimed invention by not showing the dosage of the arsenic ion is between $2 \times 10^{15}/ cm^2$ and $1 \times 10^{16}/ cm^2$, and the dosage of the phosphorous ion is between $5 \times 10^{14}/ cm^2$ and $2 \times 10^{15}/ cm^2$. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the dosage of the arsenic ion is between $2 \times 10^{15}/ cm^2$ and $1 \times 10^{16}/ cm^2$, and the dosage of the phosphorous ion is between $5 \times 10^{14}/ cm^2$ and $2 \times 10^{15}/ cm^2$, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involve only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 11, Iwata et al. differ from the claimed invention by not showing the substrate comprises monocrystalline silicon. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the substrate comprises monocrystalline silicon because it has high electron mobility of device.

Since the arsenic ions are doped into the monocrystalline silicon substrate, the arsenic ion implanted region inherently comprises an amorphous silicon region.

Regarding claim 12, Iwata et al. teach a p-n junction formed at a first interface between the channel region (106) and the buffer region (105) is separated from a second interface between the amorphous silicon region (108) and the monocrystalline silicon.

Regarding claim 13, it is inherent that point defects generated by the implanting phosphorous ions are absorbed by the amorphous silicon, such that diffusion of the phosphorous ions during the heat-treating is suppressed.

Regarding claim 15, Iwata et al. differ from the claim invention by not showing the first acceleration energy level comprises about 10 keV or less. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the first acceleration energy level comprises about 10 keV or less, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involve only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 17, Iwata et al. differ from the claimed invention by not showing an arsenic concentration in the n-type source/drain main region is between $1x10^{20}/cm^2$ and $5x10^{21}/cm^2$ and a phosphorous concentration in the n-type source/drain buffer region is between $1x10^{18}/cm^2$ and $5x10^{19}/cm^2$. It would have been obvious to one having ordinary skill in the art at the time the invention was made for an arsenic concentration in the n-type source/drain main region is between $1x10^{20}/cm^2$ and $5x10^{21}/cm^2$ and a phosphorous concentration in the n-type source/drain buffer region is between $1x10^{18}/cm^2$ and $5x10^{19}/cm^2$, since it has been held that

where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involve only routine skill in the art. In re Aller, 105 USPQ 233.

Response to Arguments

Applicant's arguments with respect to claims 3-7 have been considered but are moot in view of the new ground(s) of rejection.

It is argued, in page 5 of the remark, that Iwata et al. do not teach or suggest implanting phosphorous ions in the arsenic ion implanted regions, following the arsenic ion implanting step. This argument is not convincing because it would have been obvious to one having ordinary skill in the art at the time the invention was made to select the order of forming. See Ex parte Rubin , 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter impregnated with a thermosetting material was held to render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.).

It is argued, in page 6 of the remark, that Iwata et al. do not teach or suggest phosphorous ions are implanted into an arsenic implanted region, a subsequent heat treatment causes the phosphorous ions to diffuse deeper than the arsenic ions. This argument is not convincing because Iwata et al. teach phosphorous ions are implanted into an arsenic implanted region

(impurity diffusion region [108]), a subsequent heat treatment causes the phosphorous ions (P-doped region formed at an acceleration energy of 10-30 KeV and dose of $1x10^{13}/cm^3$-$5x10^{14}/cm^3$) to diffuse deeper than the arsenic ions (As-doped region formed at an acceleration energy of 20-50 KeV and dose of $1x10^{15}/cm^3$-$1x10^{16}/cm^3$) (fig. 1).

It is argued, in page 7 of the remark, that Iwata et al. do not teach or suggest phosphorous and arsenic are implanted at different implantation energy level. This argument is not convincing because Iwata et al. teach phosphorous ions (10-30 KeV; column 10, line 66- column 11, line 3) and arsenic ions (20-50 KeV; column 11, lines 8-12) are implanted at different implantation energy level.

It is also argued, in page 7 of the remark, that Iwata et al. do not teach or suggest the n-type source/drain buffer region extending beyond the n-type source/drain main region. This argument is not convincing because Iwata et al. teach the n-type source/drain buffer region (105) extending beyond the n-type source/drain main region (108) (fig. 1).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quang D Vu whose telephone number is 703-305-3826. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

qv
April 21, 2003

[redacted]
Steven Loke